

## Chapter II

# NAM: A Network Adaptable Middleware to Enhance Response Time of Web Services

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### Abstract

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*Web Services is an emerging software technology that is based on the concept of software and data as a service. Binary and XML are two popular encoding/decoding mechanisms for network messages. A Web Service may employ a loss-less compression technique (e.g., Zip, XMill, etc.) in order to reduce message size prior to its transmission across the network, minimizing its transmission time. This saving might be outweighed by the overhead of compressing the output of a Web Service at a server and decompressing it at a client. The primary contribution of this paper is NAM, a middleware that strikes a compromise between these two factors in order to enhance response time. NAM decides when to compress data, based on the available client and server processor speeds and network characteristics. When compared with today's common practice to transmit the output of a Web Service uncompressed always, our experimental results show NAM either provides similar*

*or significantly improved response times (at times, more than 90% improvement) with Internet connections that offer bandwidths ranging from 80 to 100 Mbps.*

## Introduction

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Many organizations envision Web services as an enabling component of Internet-scale computing. A Web service is either a computation or an information service with a published interface. Its essence is a remote procedure call (RPC) that consumes and processes some input data in order to produce output data. It is a concept that renders Web applications extensible: By identifying each component of a Web application as a Web service, an organization may combine these Web services with others to rapidly develop a new Web application. The new Web application may consist of Web services that span the boundaries of several (if not many) organizations. A final vision of Web services is to realize a dynamic environment that identifies, composes, and integrates Web services in response to a query (Ghandeharizadeh et al., 2003a). This is similar to how a relational database management system identifies and composes the appropriate relational algebra operator into a query plan to process an SQL command.

The eXtensible Markup Language (XML) produces human-readable text and is emerging as the standard for data interoperability among Web services and cooperative applications that exchange data. XML is predicted to rise from 3% of global network traffic in 2003 to 24% by 2006 and to at least 40% by 2008 (Geer, 2005). Well-formed XML documents consist of elements, tags, attributes, and so forth and satisfy precise grammatical rules. The major commercial vendors (e.g., Microsoft, IBM, etc.) employ XML to publish, invoke, and exchange data among Web services. A Web service publishes its interface using the Web Service Description Language (WSDL). An Internet application may invoke a remote Web service using the Simple Object Access Protocol (SOAP). Typically, an invoked Web service produces an XML-formatted response.

Binary encoding is an alternative encoding mechanism that produces compact streams for efficient parsing, which are not human readable. A binary formatted message is typically smaller than its XML formatted counterpart. This is because XML encoding includes repeated tags, labels, and attributes. One may employ compression in order to reduce the size of both XML and binary formatted messages.

In this study, we first quantify the performance tradeoff associated with binary and XML formatters for a decision support benchmark. Next, we analyze the role of compression in reducing the number of transmitted bytes with each encoding mechanism. With XML, we analyze two compression schemes: Zip/GZip library and XMill (Liefke & Suciu, 1999). Both employ techniques based on Lempel-Ziv

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